Long-term Variations in Surface Solar Irradiance at 5 Ground-Based Sites

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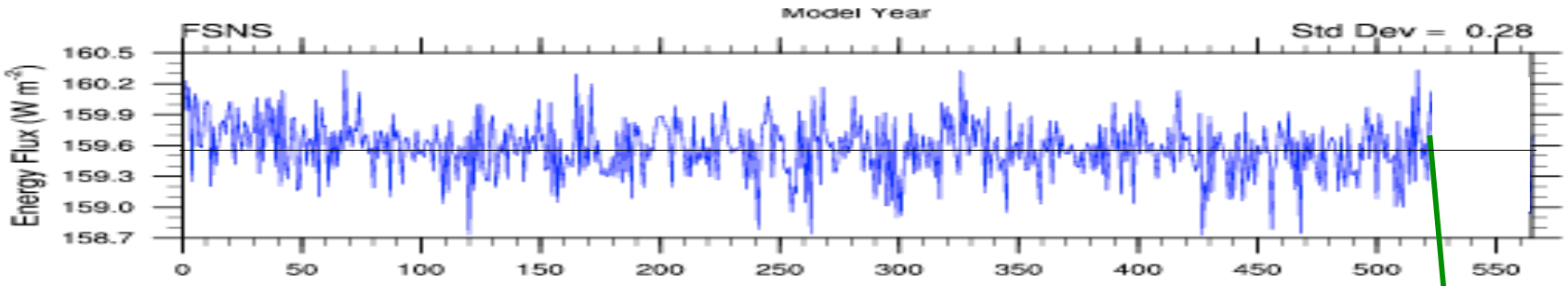
CERES S.T. Meeting

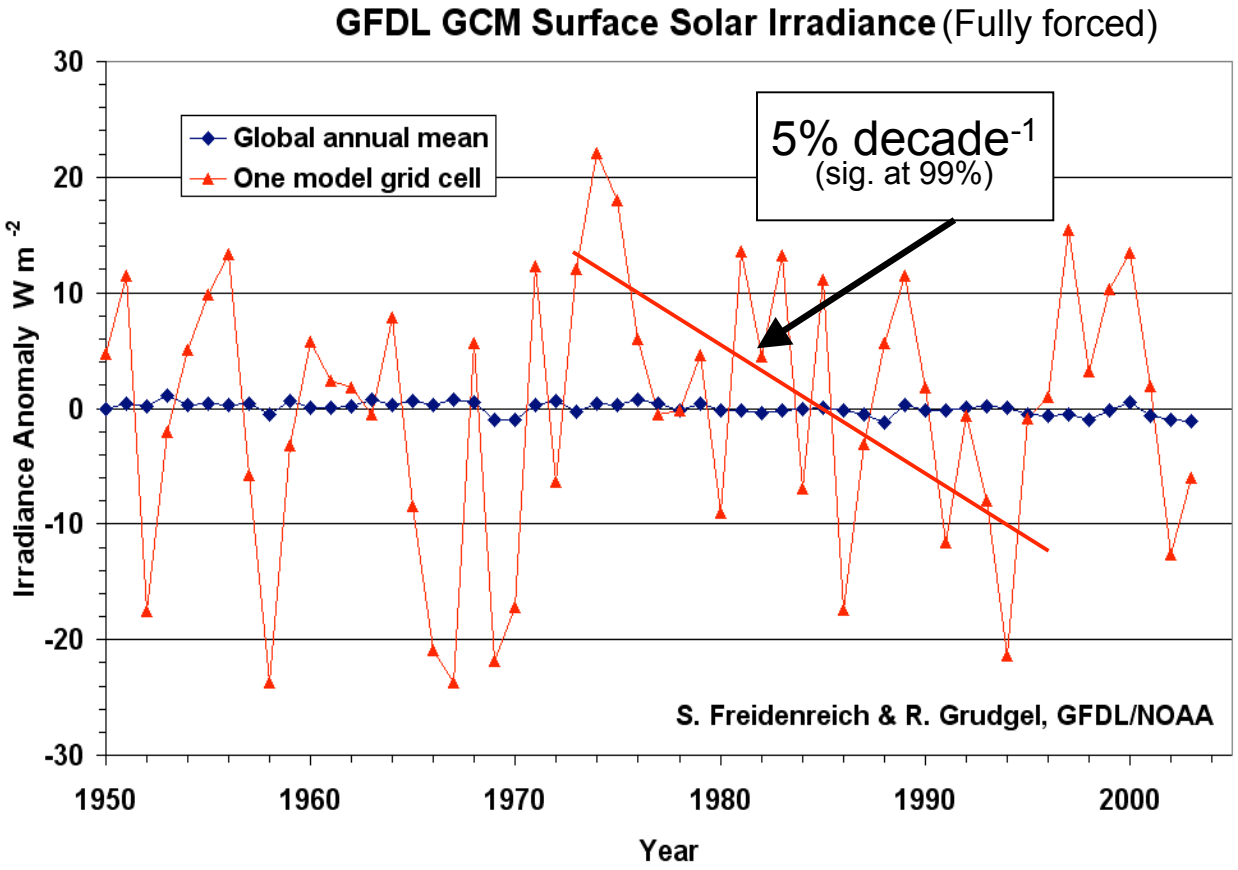
Hampton, VA

2 Nov. 2005

GCM global-mean global solar irradiance

NCAR fully coupled GCM control run for 550 years (CCSM, B. Briegleb)

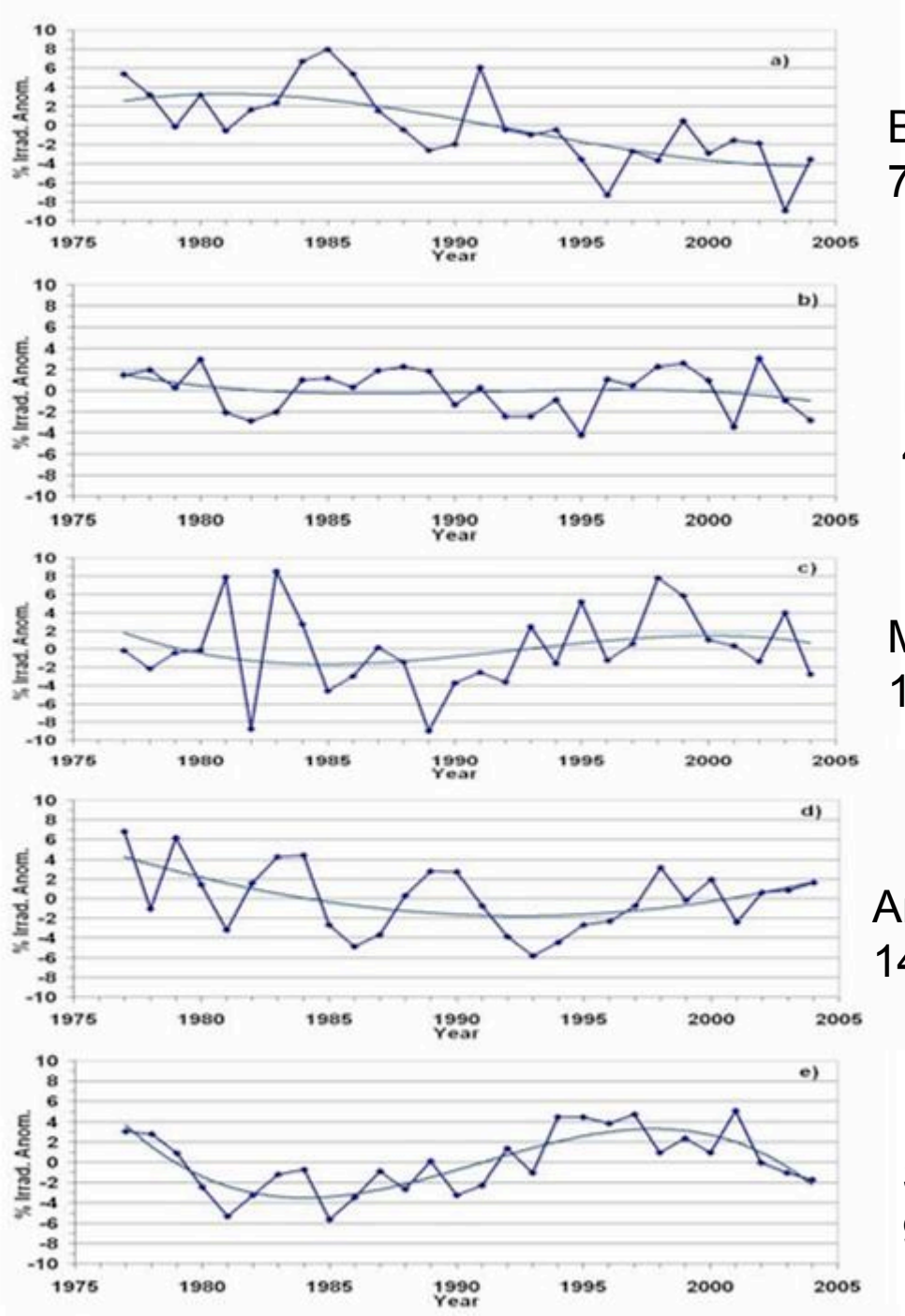




NOAA/CMDLbackground climate monitoring sites

Note: CMDL and SRRB (SURFRAD) have been combined into one group within the Global Monitoring Division (GMD) of the Earth System Science Research Laboratory (ESRL) – all of NOAA research in Boulder, CO

A new merged network and mission will likely emerge – Surface Energy Budget Network SEBN – 2 to 3 years



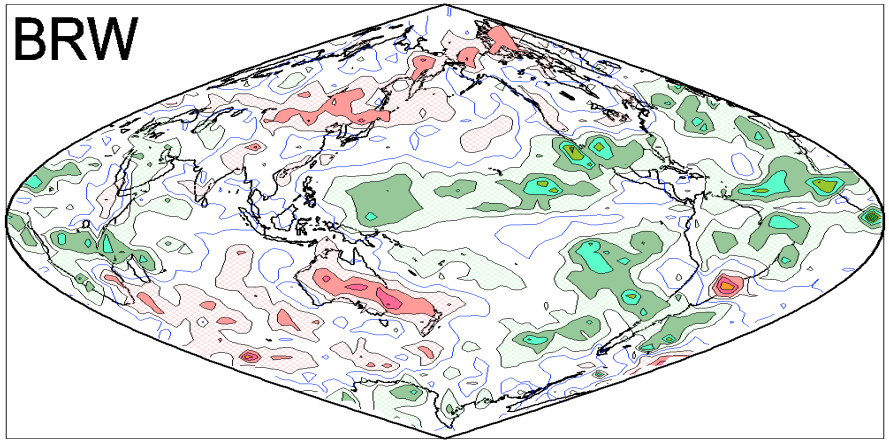
Barrow
71 N

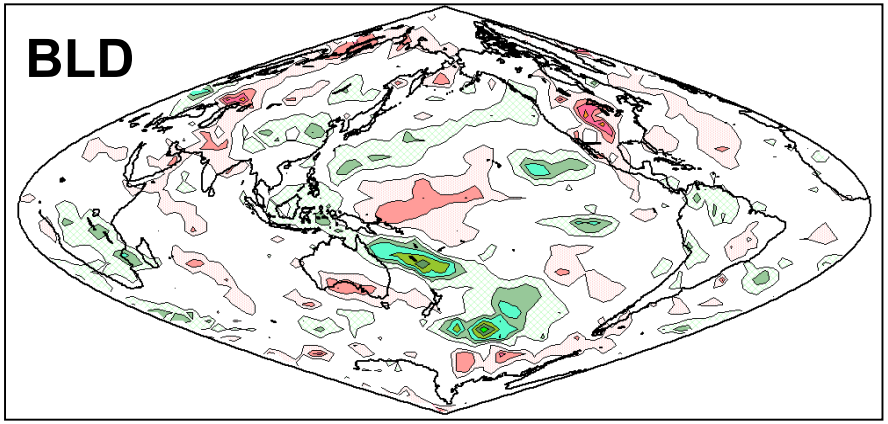
Boulder
40 N

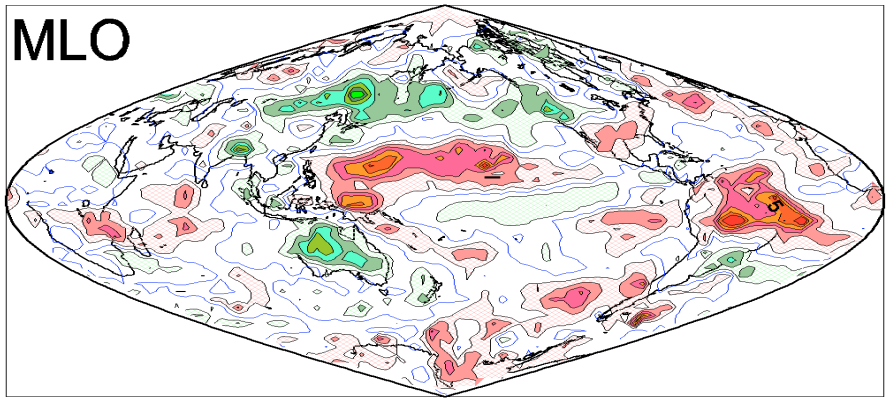
Mauna Loa
19N

Am. Samoa
14 S

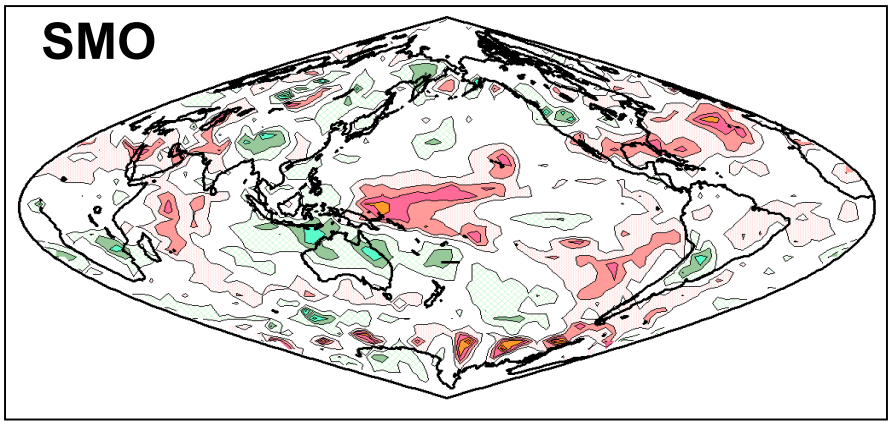
South Pole
90 S

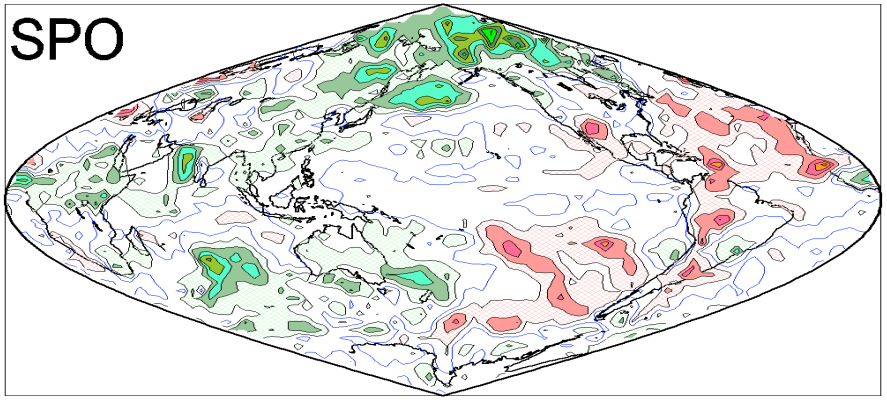


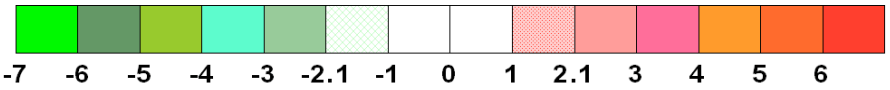




Station SW data x-correlated with ISCCP annual averages 1984 - 2000



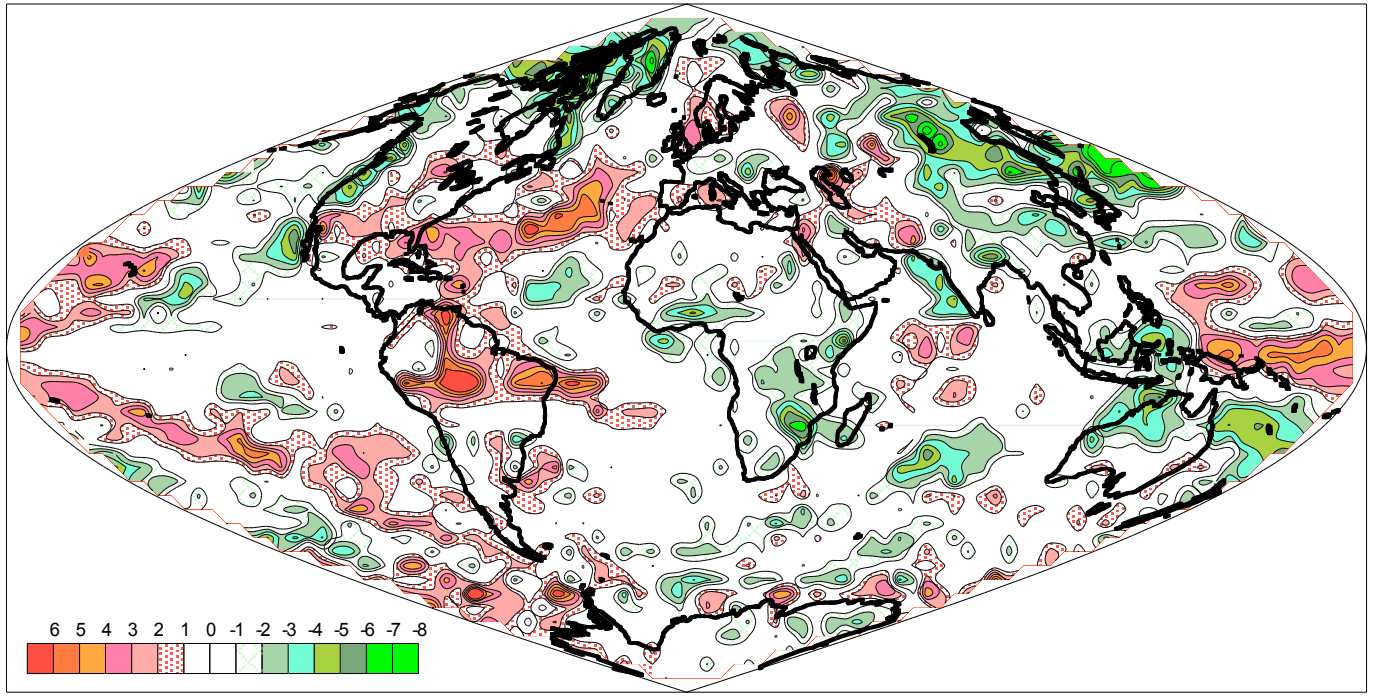


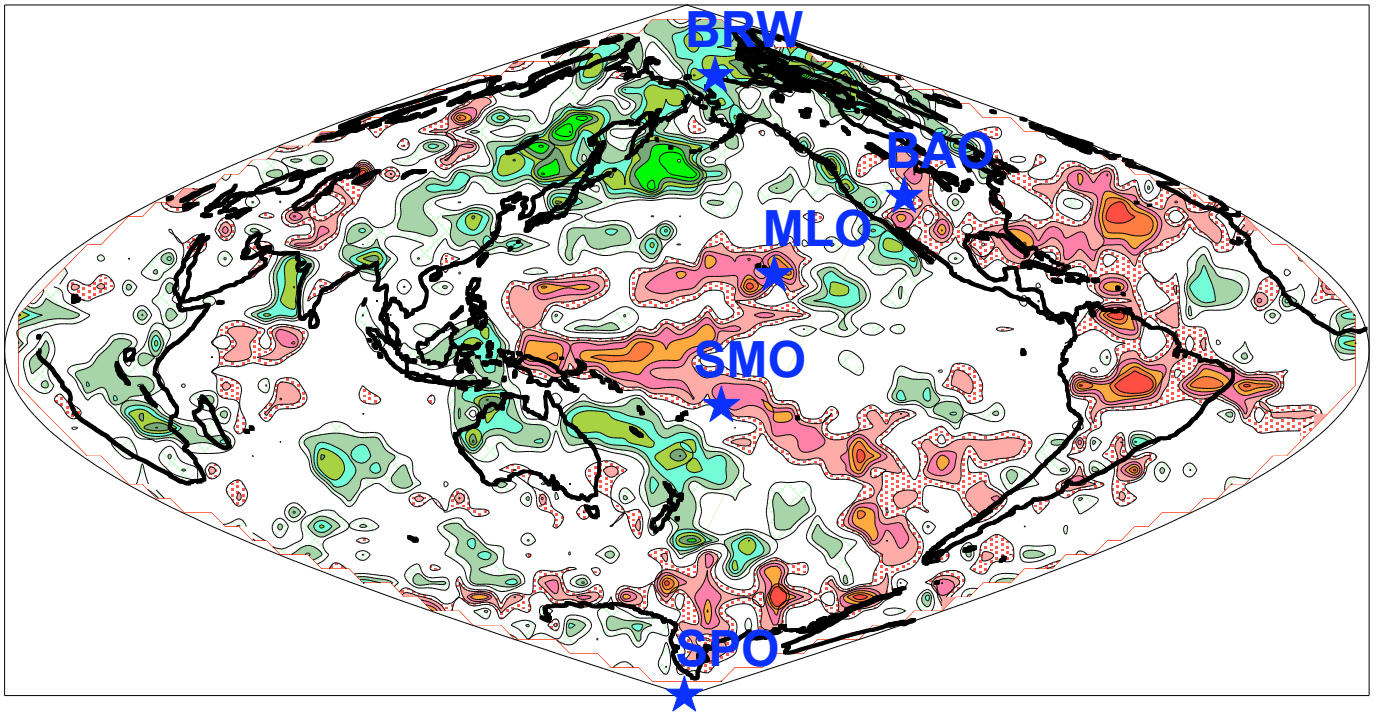


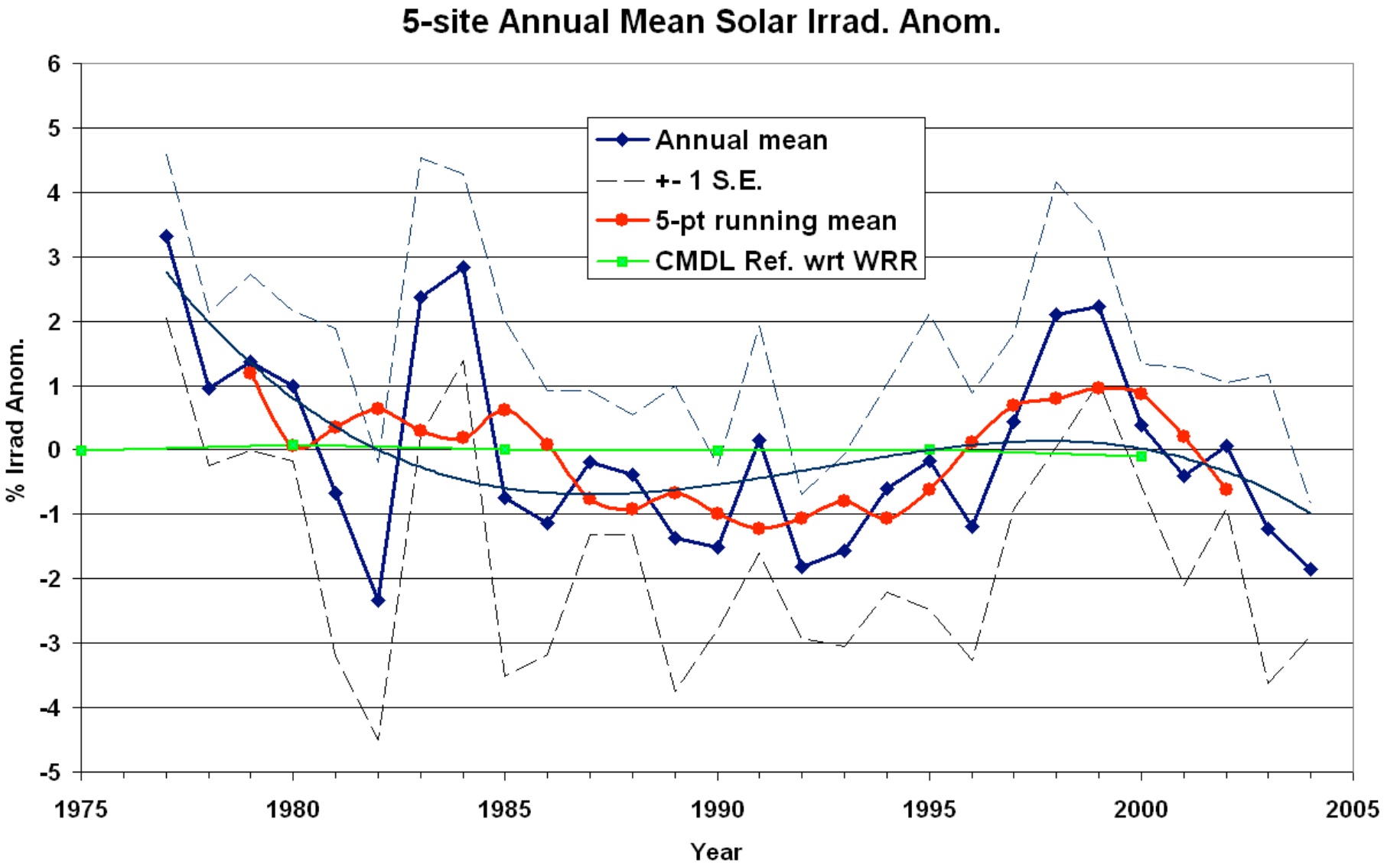
Units are X-Corr. Coef. / S. E.

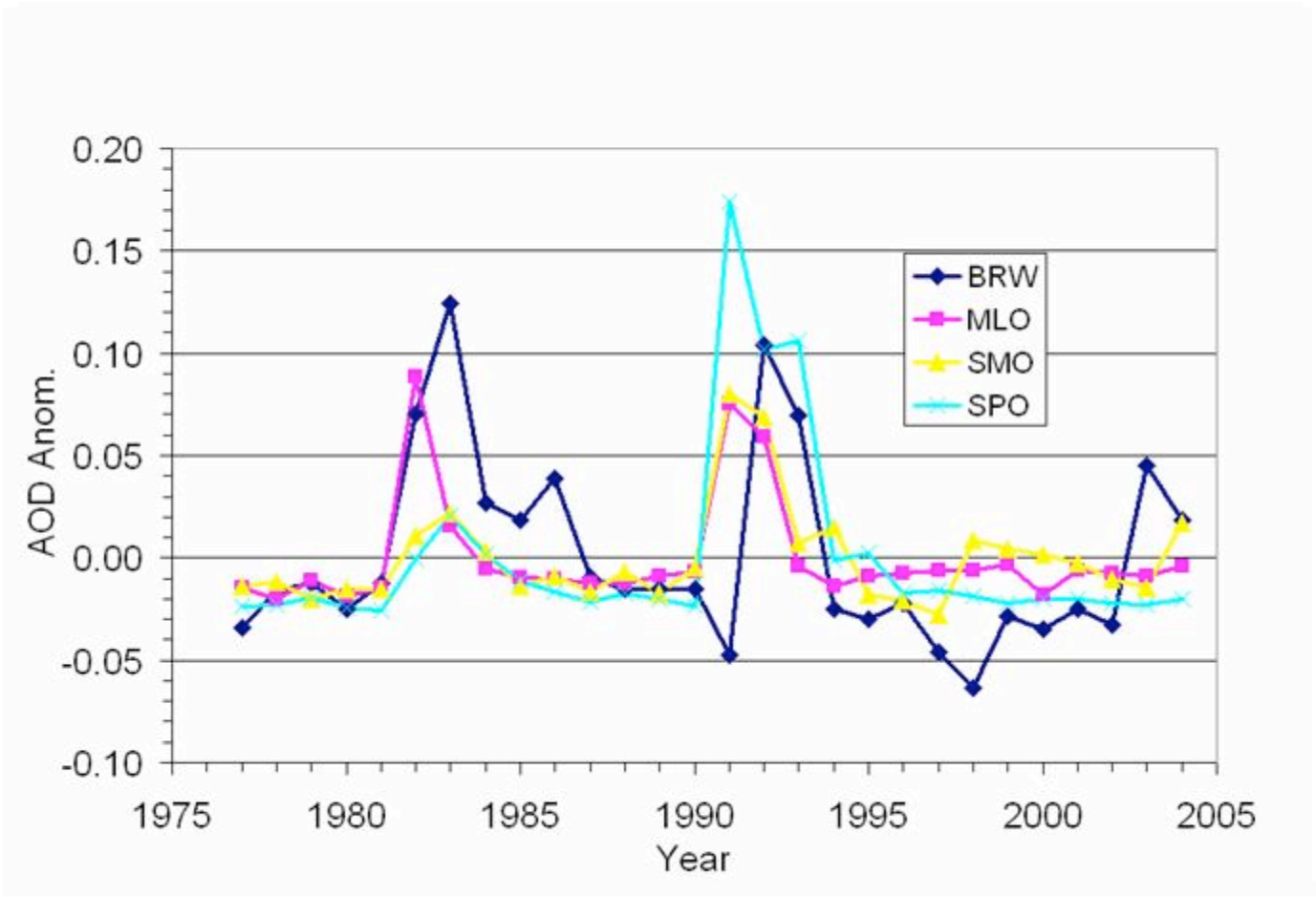
Combined xcc/s.e.
(summed if
abs(cc/s.e.) gt 2.)

Area of Earth
23% positive,
21% negative,
56% ~ 0






5-site Annual Mean Solar Irrad. Anom.
Annual mean
+- 1 S.E.
5-pt running mean
CMDL Ref. wrt WRR
% Irrad Anom.
Year
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
1975
1980
1985
1990
1995
2000
2005


0.20
0.15
0.10
0.05
0.00
-0.05
-0.10
AOD Anom.
1975
1980
1985
1990
1995
2000
2005
Year
BRW
MLO
SMO
SPO

Conclusions

- There is autocorrelated interannual variability in the CMDL surface solar irradiance records that in some cases exceeds the variability of the basic calibration references.

- Multi-decade, statistical significant trends at individual grid cells or regions are not outside the physical realm of GCMs.

- The CDML 5-station record maybe representative of up to 25% of the earth on an interannual basis and is consistent with other reports that suggest a “dimming” prior to about 1990, and a “brightening” into the 2000s, with no suggestion of an extension of brightening beyond ~2000.

- Clear-sky aerosols at the 5 sites do not explain the interannual variability in solar irradiance.

END

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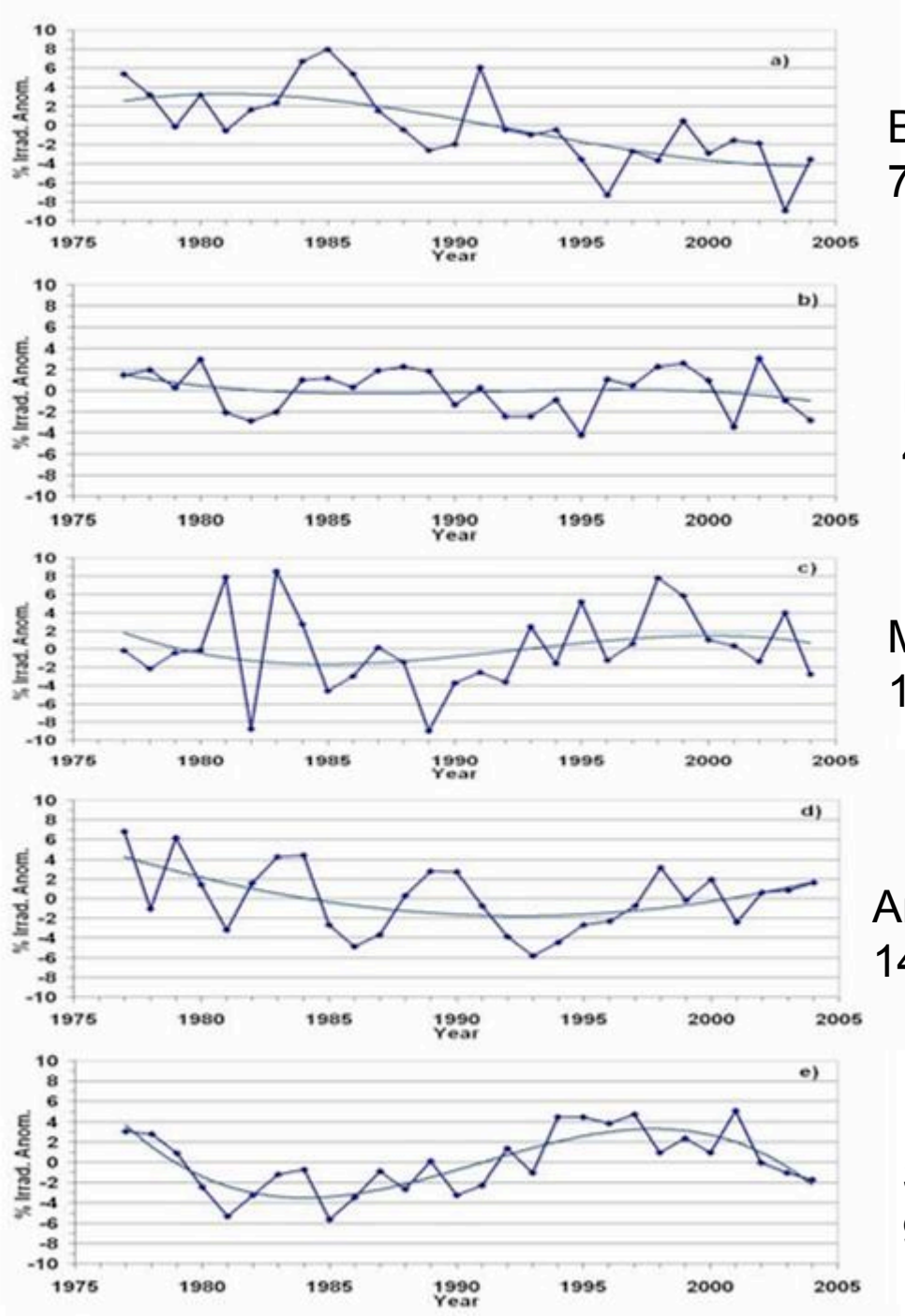

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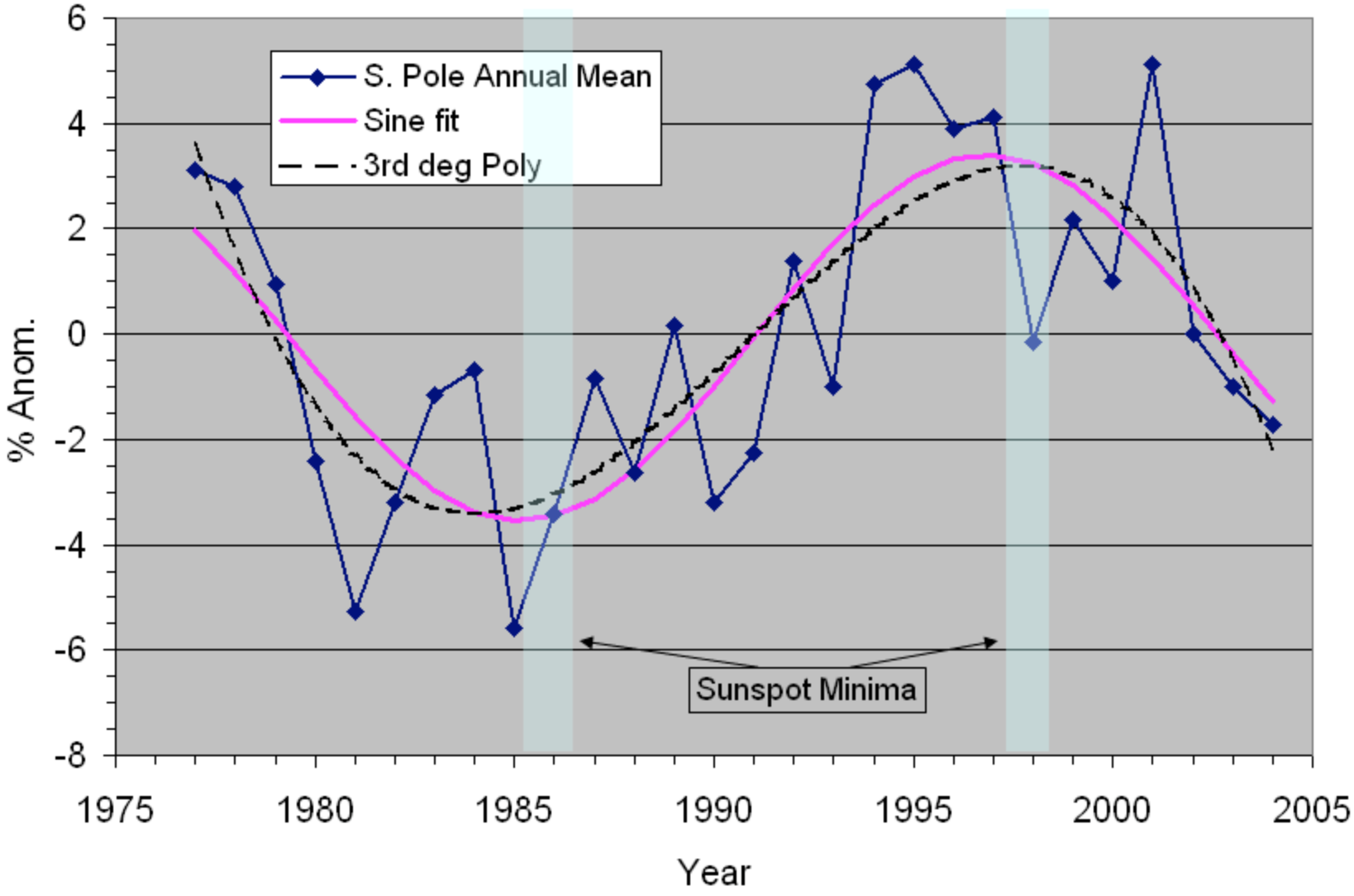
S. Pole Annual Mean
Sine fit
3rd deg Poly
Sunspot Minima
% Anom.
Year
6
4
2
0
-2
-4
-6
-8
1975
1980
1985
1990
1995
2000
2005